T674

gandalf

(LDS 309)

LDS 300B

LOCAL DATA SET

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LDS 300B

LOCAL DATA SET

INSTALLATION HANDBOOK

LDS 300B
June 1975

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INDEX

1. INTRODUCTION PAGE 1

2. PRINCIPLE OF OPERATION 1- 2

2.1 TRANSMITTER 1

2.2 RECEIVER 1

2.3 TELEPHONE LINE REQUIREMENTS 2

2.3.1 Customer Installed Lines 2
2.3.2 Carrier Supplied Lines 2

3. CONNECTIONS 2- 3

4. INDICATORS AND EXTERNAL CONTROLS 4- 6

4.1 FRONT PANEL 4

4.1.1 System Indicators 4
4.1.2 Interface Indicators 4- 5
4.1.3 Power Switch 5

4.2 REAR PANEL 5- 6

4.2.1 Telephone Line Termination 6
4.2.2 RS 232 Connector 6
4.2.3 Ground and Scope Terminals 6
4.2.4 Meter + and - 6
4.2.5 Loopback Switch 6
4.2.6 Speed Switch 7

5. STRAP OPTIONS 7- 9

6. ALIGNMENT CONTROLS AND SIGNAL QUALITY INDICATOR 10

6.1 SIGNAL QUALITY INDICATOR 10

6.2 GAIN CONTROL 10

6.3 COMPENSATION CONTROLS 10

7. INSTALLATION 10-13

7.1 PROCEDURE 11-13

7.1.1 Adjustment Procedure 11-13
7.1.2 High Speed Supplementary Instructions 13-14

INDEX

1. INTRODUCTION

The LDS 300 Series of Local Data Sets is designed for use in digital data networks and is intended to provide communication over local loops, in point-to-point and multi-drop applications. The LDS 300 is interface compatible with the Western Electric series of synchronous data sets and operates in full duplex over dedicated 4-wire lines.

2. PRINCIPLE OF OPERATION

The following brief outline describes the techniques used to transmit and receive data.

2.1 TRANSMITTER

The data encoding technique achieves a substantial reduction in bandwidth requirements when compared with conventional methods. Both clock and data are transmitted on a polar signal which reverses at intervals dependent upon the data. The time interval between consecutive reversals lies between 1 and 2 bit times, hence the highest (fundamental) frequency transmitted is half the data rate. After the encoded waveform is generated, it is filtered to remove higher harmonics to conform to ATT wire specification PUB 43401. No DC component is generated for data transmission and the output is transformer coupled to provide isolation from ground.

2.2 RECEIVER

The receiver is also transformer coupled for isolation and is designed to present a low impedance to the line (when terminated). Compensation for line characteristics is applied to the amplified signal and filters are used to control noise. A digital phase lock loop is used to generate a stable Received Clock and to decode the data from the received signal. Use of this technique permits a much wider tolerance on received signal timing errors while preserving data integrity.

2.3 TELEPHONE LINE REQUIREMENTS

LDS 300 Synchronous Data Sets operate in full duplex over a 4-wire dedicated (i.e. non-switched) communications line. Such lines may be provided by customers or by common carriers.

2.3.1 CUSTOMER INSTALLED LINES

When installing new cable, a 4-wire 22 gauge cable such as Belden 8444 or equivalent is recommended. This cable has stranded conductors and withstands sharp bends and constant manipulation. In some cases, access to lines already installed may be possible such as dedicated lines from a customer owned PBX.

2.3.2 CARRIER SUPPLIED LINES

Rented lines should be specified as "metallic pairs for Limited Distance Data Set, without loading coils". Although the LDS 300 will operate over conditioned lines, this is not essential. Line isolating transformers, often provided by common carriers, are not essential although they may improve performance. A loss of 16 dB ± 3 dB at 1 KHz for the normal line need not be met since the LDS 300 is capable of accomodating a wide range of input levels. The LDS 300 transmission output levels conform automatically to the requirements of ATT Publication 43401 "Transmission Specifications for Private Line Metallic Conductors".

3. CONNECTIONS

The LDS 300 requires the following external connections.

The Power Cord - Should be connected to a standard (grounded) power receptacle providing 115v AC 60 Hz at 5 watts. Note that signal ground is not connected internally to either the chassis or the power line ground.

The Terminal Block - Provides 4 connections for the communications line and a ground terminal for use when a ground is provided by the common carrier.

Three Monitor Points - (And a ground) are provided for signal quality measurement during installation or maintenance.

25 Pin Connector - Provided for the business machine. Voltage and signal levels are RS 232C compatible. A full list of the interface signals available is given in Table 1.

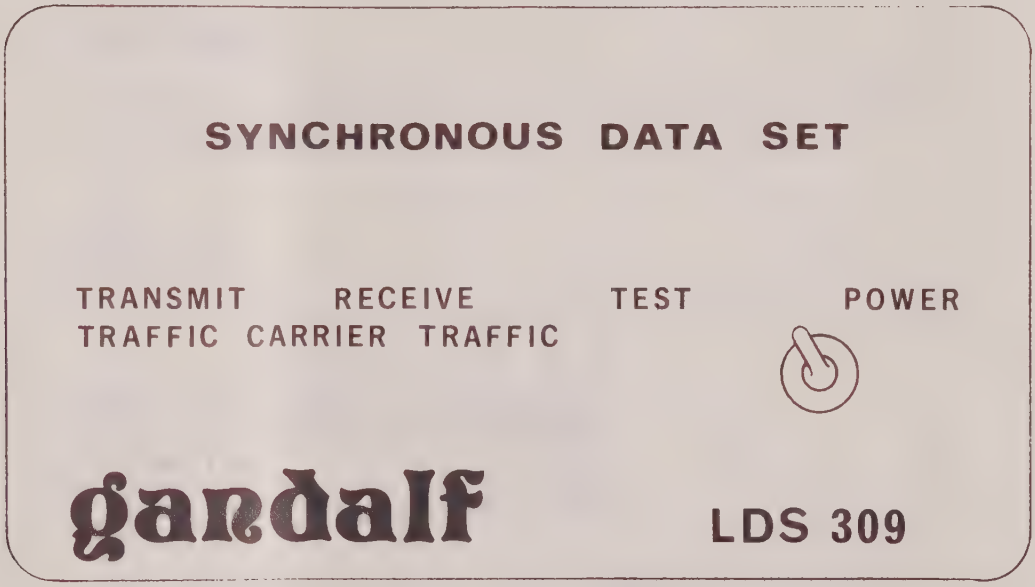
Table 1

Pin	Signal
1	Frame Ground
2	Send Data
3	Receive Data
4	Request to Send
5	Clear to Send
6	Interlock or Data Set Ready
7	Signal Ground ckt common
8	Carrier Detect
9	+12v DC (test purposes only)
10	-12v DC (test purposes only)
11	Not used
12	Not used
13	Not used
14	Not implemented
15	Serial Clock Transmit
16	Not implemented
17	Serial Clock Receive
18	Not implemented
19	Not implemented
20	Not used
21	Not implemented
22	Not implemented
23	Not implemented
24	External Clock (strap option)
25	Not used

4. INDICATORS AND EXTERNAL CONTROLS

The following Indicators, Connectors and Switches are provided.

4.1 FRONT PANEL



4.1.1 System Indicators

POWER	Confirms that power is applied to the unit.
TEST	This indicator will not be lit in normal use. When lit indicates the LDS 300 is in the loopback condition. In this condition signals received from the telephone line are decoded, re-encoded again, and transmitted back to the Central Office. Also in this condition the RS 232C signal of Transmit Data is looped back to the business machine as Receive Data but the signal Data Set Ready is made False.

4.1.2 Interface Indicators

RECEIVE TRAFFIC	When lit indicates data transitions are occurring on the customer Receive Data lead (Pin 3).

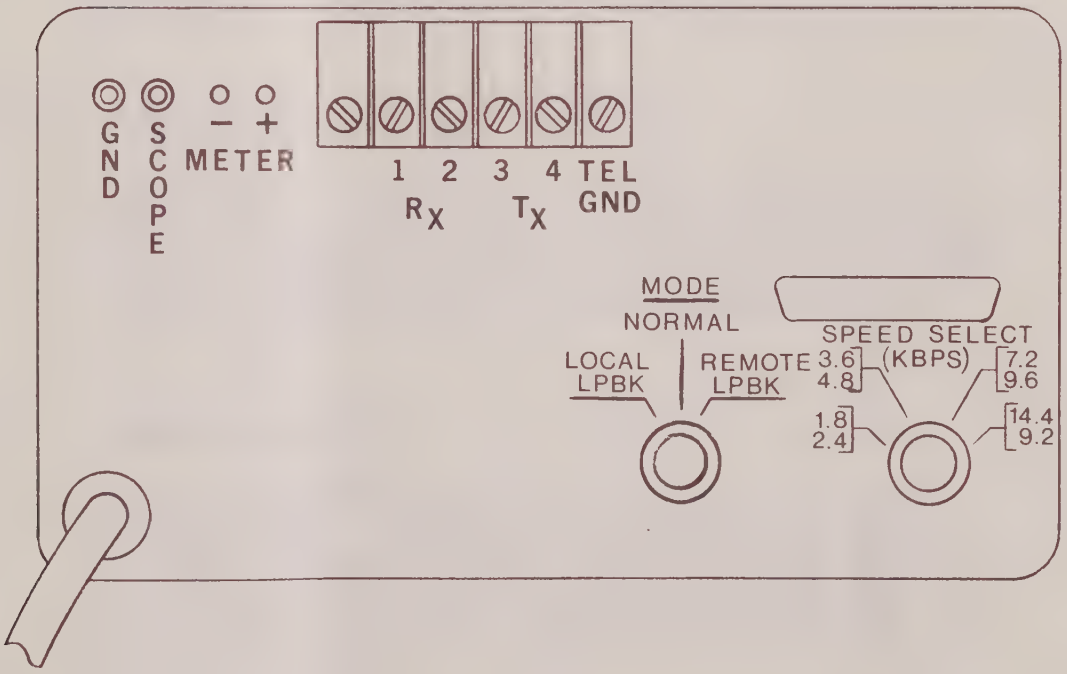
RECEIVE CARRIER — When lit indicates that the customer Data Carrier Detect lead (Pin 8) is high.

TRANSMIT TRAFFIC — When lit indicates data transitions are occuring on the customer Transmit Data lead (Pin 2).

4.1.3 Power Switch

A switch is provided on the front panel to control power to the unit.

4.2 REAR PANEL



4.2.1 Telephone Line Termination

A five termination terminal block. Pins 1 and 2 are for the receive pair and Pins 3 and 4 for the transmit pair. The fifth termination may be used for a telephone ground connection.

4.2.2 RS 232 Connector

A connector for the customer's business machine.

4.2.3 Ground and 'Scope Terminals

Provision for connecting an oscilloscope to observe the amplified and equalized received line signal.

4.2.4 Meter + and -

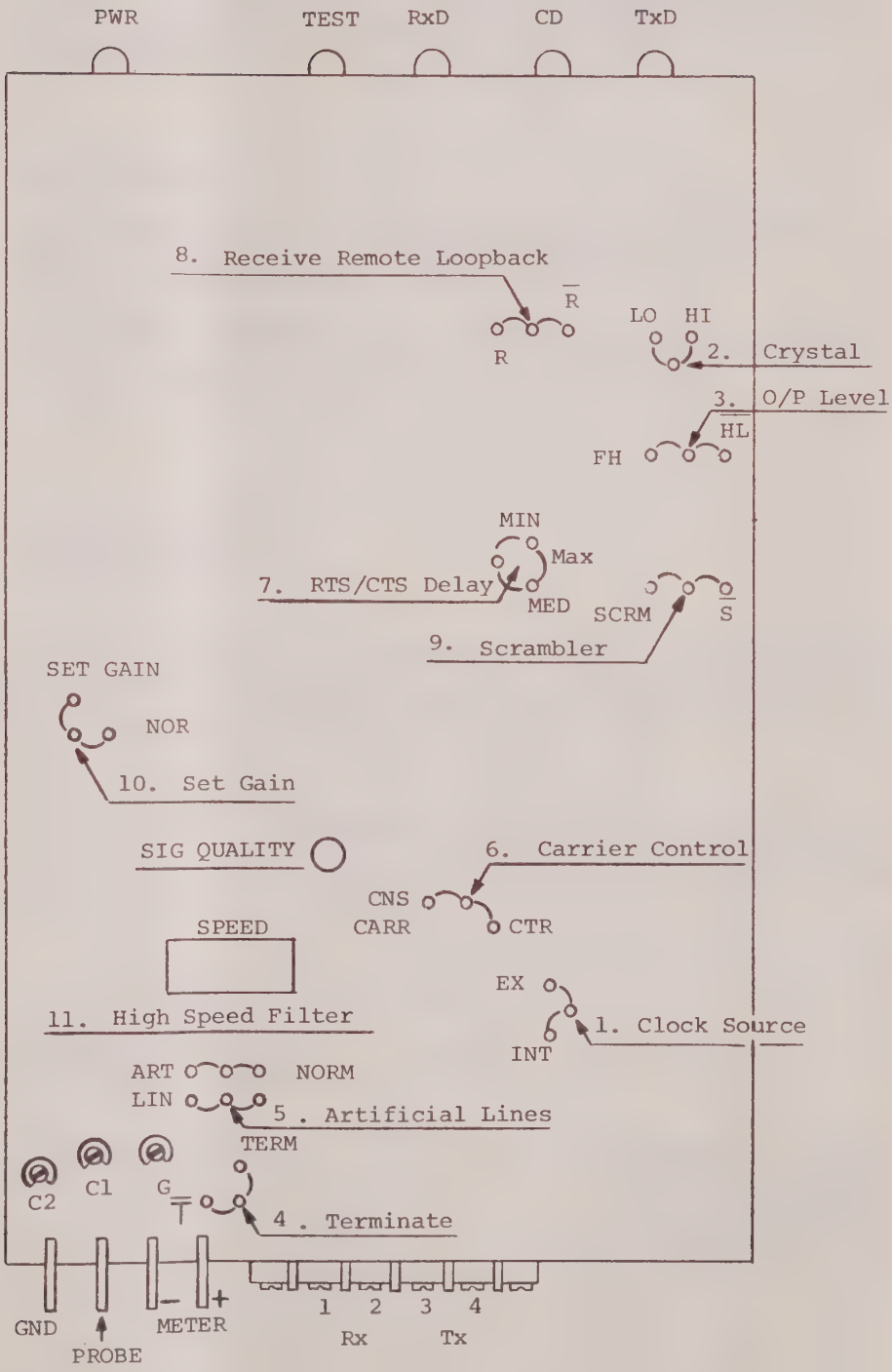
Provision for connecting a voltmeter with standard .080" probes to measure a voltage representing signal quality. Minimum voltage corresponds to best signal quality. Meter should be on a 10 volt DC range and have impedance of at least 1K ohm per volt.

4.2.5 Loopback Switch

For data transmission this switch will be in the NORM position. In LOCAL LPBK position the unit is in digital loopback mode. This causes the business machine transmit data to be looped back to the receive data output and the received data from the line to be decoded, re-encoded and transmitted back down the line.

To cause the remote end unit to go into digital loopback turn the loopback switch to REMOTE LPBK momentarily and back to NORM. The remote unit will

STRAP OPTIONS



be placed in digital loopback by momentary transmission of auxillary channel signal. Loss of receive carrier energy will cause the unit to revert to normal mode. Remote loopback may thus be cancelled by switching the local unit off momentarily.

4.2.6 Speed Switch

The speed switch will have three positions for 9600 bps top speed or four positions if the unit is rated for 19.2 Kbps operation.

The highest speeds of 19,200 and 14,400 may only be used if the High Speed Filter Module is present. (Ref. Paragraph 5, option 11)

5. STRAP OPTIONS

Remove the cover by unscrewing the four rubber feet and sliding the cover off the frame. This allows access to several strap options. The following diagrams of strap options are illustrated with the front panel away from you.

1. Clock, INT/EX

Normally in INT position. The strap may be positioned to select the desired source of Transmit Clock. INT selects the Internal Clock Source.

EX selects an external clock source from Pin 24 of RS 232 interface

2. LO/HI Crystal Select

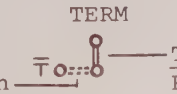
Normally in HI position
Selects the crystal source for 19.2 Kbps (HI) or 14.4 Kbps (LO) operation

3. Force Output Level Normally in Automatic Position.

This position Output level forced high irrespective of speed.

This position normal. Output level automatically adjusted with speed selection to conform to PUB 43401.

4. Terminate

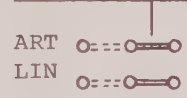


This position normal. Receive telephone line pair terminated in 470 ohms.

In this position receive telephone line pair is unterminated. For use in certain multi-drop installations.

5. Artificial Line (Local Analog Loopback)

These positions normal.



These positions used for testing purposes. Connects a five mile artificial line between transmit and receive line terminals.

6. Carrier Control

This position will transmit continuously irrespective of state of customer's Request to Send lead (Pin 4).

This position allows control of transmit energy from customer's Request to Send lead (Pin 4).

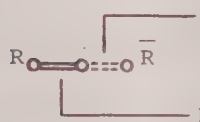
7. RTS/CTS Delay

Minimum delay of 2 milliseconds. To be used only if constant carrier is selected.

This position Maximum Request to Send to Clear to Send delay of approximately 55 milliseconds.

This position Normal. Medium delay 8 milliseconds.

8. Select Remote Loopback Command



Remote Loopback Command ignored.

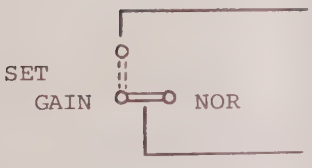
Normal Position. Remote Loopback Command may be received from the remote LDS 300.

9. Select Scrambler Mode.

Disable Scrambler

Normal Position. Enables Scrambler. Also used to provide data traffic during alignment.

10. Set Gain

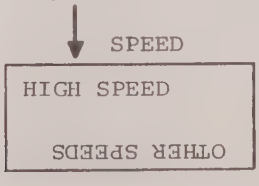


Reduced gain to provide check on carrier detect margin during alignment procedure.

Normal Position.

11. High Speed Filter Module

Plug in filter position provided for the optional High Speed Filter Module. Module must be inserted in the HIGH speed position for 19.2K bps and 14.4K bps. Module may be stored by reversing it. In the reverse position the OTHER SPEED designation is alongside the SPEED legend on the board for operation at the other than the highest two speeds.



6. ALIGNMENT CONTROLS AND SIGNAL QUALITY INDICATOR

6.1 SIGNAL QUALITY INDICATOR

Provided for visual indication of signal quality. Alignment proceeds to minimize flashing of this indicator. Flashing of this indicator during use does not necessarily indicate errors are being generated.

6.2 GAIN CONTROL

Potentiometer provided to control gain of receive circuit. Adjusted during installation.

6.3 COMPENSATION CONTROLS

C1 and C2 - provided to give compensation adjustment to the receive line. Adjusted during installation.

7. INSTALLATION

The LDS 300 is usually used for point-to-point or multi-drop applications as in Fig.1.

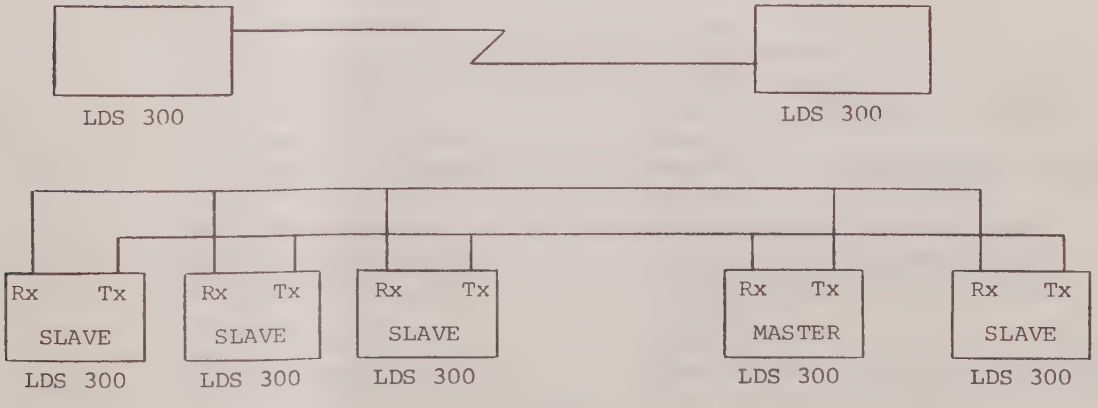


Fig.1

Basic operation is the same in each case although certain details of the installation or adjustment procedure may differ.

7.1 PROCEDURE

The LDS 300 may be placed in a convenient position adjacent to the business machine which it serves but access to the rear panel is required to connect the business machine and communications line. The supply cord requires a 115v AC 60 Hz receptacle. The procedure which follows describes the alignment of a LDS 300 at an installation site using the scrambler feature and the receive traffic indicator for error indication.

A test message generator may be used for the set up procedure but in this case the Receive Traffic indicator will be on and will not be available to indicate transmission errors.

7.1.1 Adjustment Procedure (for HIGH SPEED adjustment see para 7.1.2)

1) Remove the cover by unscrewing the four rubber feet from the bottom and sliding the cover off the frame.

2) Connect the line to the LDS 300 (by convention, the red/green pair is used for Tx Terminals 3 and 4 at the local end).

3) Set straps in both local and remote units as follows.

1.	Clock Source	INTernal
2.	Crystal	As appropriate
3.	Output Level	As appropriate
4.	Terminate	As appropriate(usually TERM)
5.	Artificial Line	Normal
6.	Carrier Control	Must be set to CNS CARR (Constant Carrier)
7.	RTS/CTS Delay	As appropriate (Usually MED)
8.	Remote Loopback	As appropriate (Usually R)
9.	Scrambler	Must be set to SCRM (Scrambler Selected)
10.	Set Gain	Normal
11.	High Speed Filter	Other speeds, unless highest speed is selected

Switch both units to the highest speed to be used on link.

Selecting the scrambler feature SCRM (Strap 9) causes the remote unit to transmit the signal required for receiver adjustment at the installation site.

4) Start receiver adjustment at the local unit. Set the Gain Potentiometer for maximum (clockwise). Set the Equalization pots for minimum (counter-clockwise). Observe Carrier Detect light on front panel.

If ON : Follow Short Line Procedure
Proceed to Step 5

If OFf : Follow Long Line Procedure
Proceed directly to Step 6

5) Procedure for Short Lines

Rotate the gain potentiometer G slowly towards minimum (counter-clockwise) and observe the Signal Quality light and the front panel RECEIVE CARRIER light.

Set the gain potentiometer at that setting which gives the least indication of the Signal Quality light or the meter deflection consistent with RECEIVE CARRIER light on. Proceed with Step 6. If no null indication is observed set the gain potentiometer to maximum (clockwise) and proceed with Step 6.

6) Continuation of set-up procedure. Rotate the equalization potentiometer C1 slowly clockwise until a null indication of signal quality is observed. On very long lines C1 will reach maximum, and additional compensation may be added by rotating C2 clockwise slowly until a null is reached. Proceed to Step 7.

7) Signal Level Adjust. Remove SET GAIN strap from NORmal position and adjust GAIN pot so that the RECEIVE CARRIER light just stays on. If RECEIVE CARRIER light will not come on with SET GAIN strap out, put GAIN pot to maximum gain.

Replace SET GAIN strap in NORmal position.

Receive Traffic. The RECEIVE TRAFFIC light should now be off and not flashing. A flash indicates receiver errors with possible causes of a misadjusted receiver or an unsuitable telephone line pair.

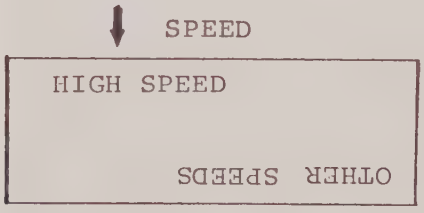
If receive traffic indicator does not flash, error free transmission has been achieved in one direction of transmission.

Adjustment of Receiver at Other Site. Follow same adjustment procedure at other site starting at Step 4.

Strappings. Set appropriate strappings for system configuration, replace cover and insert business machine cable.

7.1.2 HIGH SPEED SUPPLEMENTARY INSTRUCTIONS (14.4 AND 19.2 KBPS)

1) Be sure that HIGH SPEED Module is inserted in socket correctly as shown.



2) Fine tuning may be aided by using a voltmeter. Connect voltmeter on 10 volt range to meter + and - sockets on rear of unit. Tuning should proceed for minimum deflection of voltmeter.

3) Contrary to 7.1.1 step 3 put SET GAIN strap in SET GAIN position permanently.

4) Compensate as per 7.1.1 adjustment procedure. In Step 6 the best null will be achieved by using both C1 and C2 pots instead of only C1 pot. No more than approximately 1/3 of a turn of each pot should be necessary.

If using a meter a good minimum should occur on 2 volts or less.

THE DATA LINK IS NOW READY FOR USE.